1050 SERIES

CONSTANT TEMPERATURE

ANEMOMETERS AND ACCESSORIES

MEASURE

- VELOCITY
- MASS FLOW
- TURBULENCE
- PRESSURE
- TEMPERATURE

IN LIQUIDS AND GASES

THERMO-SYSTEMS INC. ST. PAUL, MINNESOTA

Bulletin No. 1050

NEW – 1050 SERIES CONSTANT TEMPERATURE ANEMOMETER SYSTEM

A complete set of solid state modular instruments that the user can combine to form a flow measuring system as simple or complex as the application demands.

IMPORTANT SYSTEM CHARACTERISTICS

RANGE – Can exceed 10,000 to 1. An inherent advantage of Constant Temperature Anemometers is the wide velocity or flow range over which a single sensor can operate. Velocity ranges from a few feet per minute to supersonic can be covered with one sensor. With In-Line Mass Flow Sensors a dynamic range of 1000 to 1 is readily achieved.

ACCURACY – at 0.1% level. The 1050 series has been designed to optimize system accuracy. Components have been selected for precision and low temperature drift without recalibration. The new linearizer provides precision not previously possible with calibrated accuracy of ½% of reading over a flow range greater than 100 to 1. Actual calibration curves are linearized rather than exponential or "Kings Law" approximations. Accuracy and stability of anemometer systems depend on the type of sensor and contamination of fluid streams. TSI offers hot wire, hot film and cooled film sensors to fit each application (Refer to page 9).

FREQUENCY RESPONSE – up to 500,000 Hz. System frequency response depends on the choice of anemometer, type of sensor, fluid and flow rate. TSI anemometers are designed to optimize response. Flat response on both hot film and hot wire sensors is achieved using high gain on both DC and AC signals. See Bulletin N16-2 for a comparison of frequency response by sensor type.

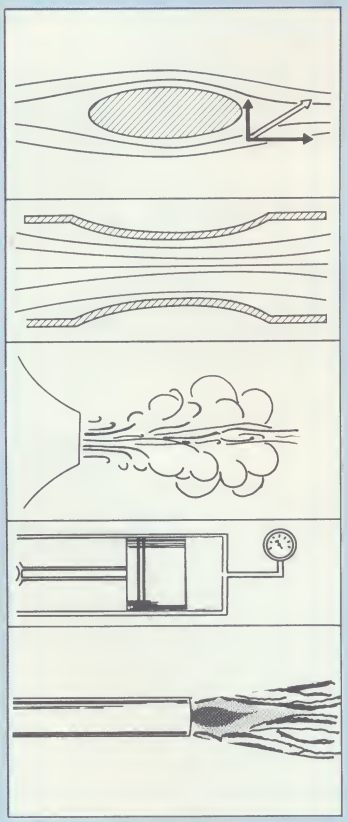
LOW NOISE LEVEL – HIGH SENSITIVITY – less than 0.02% in 10 KHz bandwidth. A low noise level makes high frequency response useful. TSI anemometers have the lowest noise level in the industry. A noise level of 0.02% equivalent turbulence intensity (0-10 KHz bandwidth, 0.20 mil tungsten hot wire at 300 fps) has been achieved on the Model 1050. The Model 1057 Signal Conditioner can be used to filter unwanted frequencies for lower system noise level.

TEMPERATURE COMPENSATION. "Constant Temperature Anemometer" implies that the sensor is operated at a fixed temperature (see Principle of Operation). In this mode the sensor is sensitive to fluid temperature as well as flow. TSI offers temperature compensated probes to make the system output independent of temperature when measuring flow.

LARGE, LINEAR OUTPUT SIGNALS – 0-10V. Feedback control on the bridge of the constant temperature anemometer provides a large output voltage (up to 20 volts for non-linear output). The linearizing circuits give a 0-10 volt output for each velocity or flow range.

FAIL SAFE CIRCUITS. Each anemometer module is equipped with a special protecting circuit that turns the amplifier off whenever the probe, cable, control resistor or line current is disconnected making sensor burn-out virtually impossible.

MEASUREMENT CAPABILITY



VELOCITY – Measure profiles in tunnels, pipes, around models, in small and large spaces, both steady and transient. VELOCITY COMPONENTS AND DIRECTION – Using multi-channel systems, velocity vectors can be completely defined in both steady and fluctuating flows. (For probe selection see page 9.)

Range in Gases: A few ft/min to high supersonic.
Range in Liquids: A few inches/min. to 100 fps.
Temperature Range: Cryogenic to +1000°F (non-cooled), 7500°F (cooled probes).

MASS FLOW – For in-line mass flow measurement in liquids and gases the Model 1292 and 1352 Flow Sensors are offered. The basic advantages are high response, large dynamic range and very good sensitivity.

Range in Gases: from 0.1 scc/min to 300 scfm.
Range in Liquids: from 0.01 cc/min to 30,000 #/hr.

TURBULENCE AND CORRELATIONS – Turbulence fluctuations can be measured up to very high frequencies. A true RMS voltmeter (Model 1060) is used on the output to obtain turbulence intensities, scale, etc. and is combined with the 1015C Correlator to determine correlations between two points, two directions, or velocity vs. some other variable. A unique second summing circuit allows correlation coefficients to be read directly on the 1060 RMS Meter even for "X" probes.

PRESSURE – A new pressure transducer is offered by TSI to be used with anemometer circuits to measure steady and fluctuating pressures. This device can be very small (0.025" dia.), has high response (DC to 10 kHz) stays clean and is very rugged. Write for Bulletin 1410.

TEMPERATURE – Model 1050, 1053A and 1054A anemometers have a built-in provision for temperature measurement. The Model 1040 Temperature and Switching Module contains a resistance bridge and amplifier for continuous temperature measurement (0-10v output). Both velocity and temperature can be measured with one sensor at one point by switching with the Model 1040.

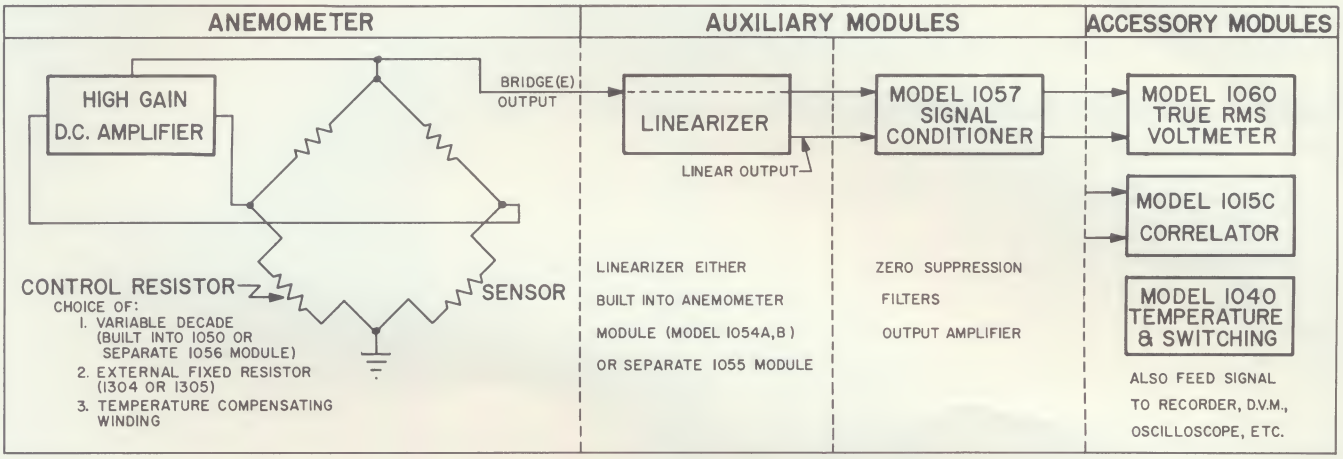
For high frequency temperature measurements TSI builds a line of aspirating probes that can be used in very hot gases. See Bulletin C26-2.

OTHER MEASUREMENTS – Many other applications have been made including response of pneumatic and hydraulic devices, void fraction and spray studies, indicators for flow control systems, stall indications and blade wakes in compressors, flow system balancing, heating rates in hot gases, flame studies and numerous others.

PRINCIPLE OF OPERATION

A constant temperature anemometer instantaneously measures fluid flow parameters by sensing the heat transfer rate (heat flux) between an electrically heated sensor and the flow medium. The basic signal depends on the fluid composition, mass flow and temperature difference. For many measurements density is constant and the instrument measures velocity. When temperature varies, compensation is provided to maintain a constant temperature difference.

The sensor is heated by current from the amplifier (see block diagram). As flow increases the sensor tends to cool causing an off-balance of the bridge. This off-balance is immediately sensed by the amplifier which feeds back more current to bring the bridge back into balance. Hence, the sensor is controlled at a certain resistance (hence temperature) that depends on the value of the "Control Resistor" in the opposite leg of the bridge.



BRIDGE OUTPUT — The basic output signal is a voltage which is related to flow approximately as follows:

$$E^2 \sim [A + B(\rho V)^{\frac{1}{n}}](t_s - t_e),$$

where A, B are constants depending on fluid properties, ρ = fluid density, V = velocity, n = exponent that varies with range and fluid (usually about 2), t_s = sensor operating temperature and t_e = fluid (environmental) temperature. Measurements are made by either plotting a non-linear calibration curve of flow vs. voltage for each probe or by adding a linearizing circuit to give a more convenient output. When density is constant the measurement is velocity.

The curves below are sample calibrations for typical sensors in air and water.

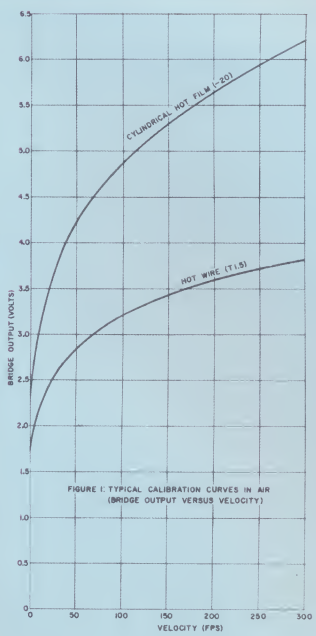


FIGURE 1: TYPICAL CALIBRATION CURVES IN AIR (BRIDGE OUTPUT VERSUS VELOCITY)

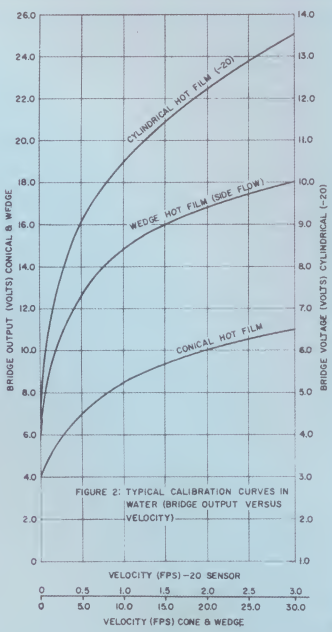


FIGURE 2: TYPICAL CALIBRATION CURVES IN WATER (BRIDGE OUTPUT VERSUS VELOCITY)

CONTROL RESISTOR — The control resistor is an important element in the bridge. It is used to set the sensor operating temperature and to provide temperature compensation. There are four choices of control resistors:

1. A single, fixed resistor (Model 1304 or 1305).
2. A set of resistance decades for convenient adjustment of operating temperature (Model 1056 or built into Model 1050).
3. A resistance winding mounted in the probe to vary resistance with temperature providing automatic temperature compensation.
4. A small resistance element as part of the Model 1025 Temperature Compensator to provide temperature compensation over a wide range of conditions.

LINEAR OUTPUT — Since the bridge output is non-linear and has a residual DC voltage at zero flow, a linearizer is a convenient addition to the system. The actual calibration curve is linearized rather than an empirical or theoretical equation which a given sensor does not exactly follow. Linearizers have interchangeable plug-in function cards that give a linear output for a given sensor type, range and fluid. The Model 1055 Linearizers come with adjustable cards so the user can match either exponential or non analytic calibration curve shapes by adjusting the linearizer. Linearized outputs are direct reading in units of flow. An example linearized calibration curve is shown at right.

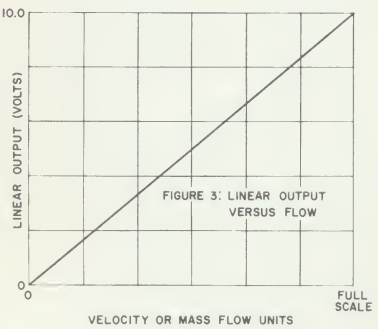


FIGURE 3: LINEAR OUTPUT VERSUS FLOW

FOLD OUT

FOLD OUT

SYSTEMS

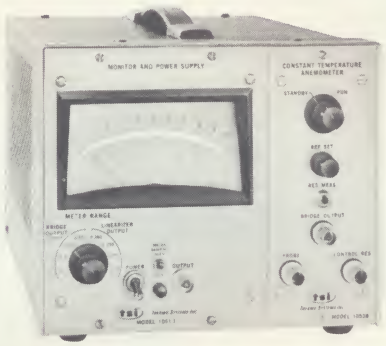
Modules are selected by using the selection procedure on pages 5, 6 and 7. The systems shown here illustrate the flexibility of the system.

SINGLE CHANNEL SYSTEMS:

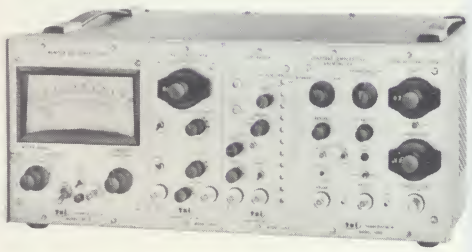
For measurements of velocity, flow, turbulence and/or temperature at one point. Simple, portable units (A.C. or battery operated) and versatile, general purpose laboratory instruments can be assembled from the various modules offered. The typical single channel system includes:

- **1 — Anemometer Module**
- **1 — Monitor and Power Supply Module**
- **1 — Cabinet**
- **1 — Probe (single sensors) and control resistors**

plus any auxiliary modules and accessory circuits shown on pages 5-7.



PORTABLE SYSTEMS:
BATTERY OR AC POWER.



VERSATILE
LABORATORY
INSTRUMENTS.

DUAL CHANNEL SYSTEMS

For simultaneous measurement of flow, velocity and/or temperature in two locations. A common power supply operates both channels. Dual channel systems are used for correlation between two flow directions or locations, input-output analysis of flow systems, velocity components and direction in two dimensional flow and separation of temperature and velocity variables at high frequency. The typical dual channel system includes:

- **2 — Anemometer Modules**
- **1 — Monitor and Power Supply Module**
- **1 — Cabinet**
- **1 — Two sensor probe or 2 — single sensor probes and control resistors**

plus auxiliary modules and accessories shown on pages 5-7.

(Correlator and RMS voltmeter are commonly required.)

COMPACT
PORTABLE
UNITS

COMPLETE GENERAL
PURPOSE SYSTEMS.

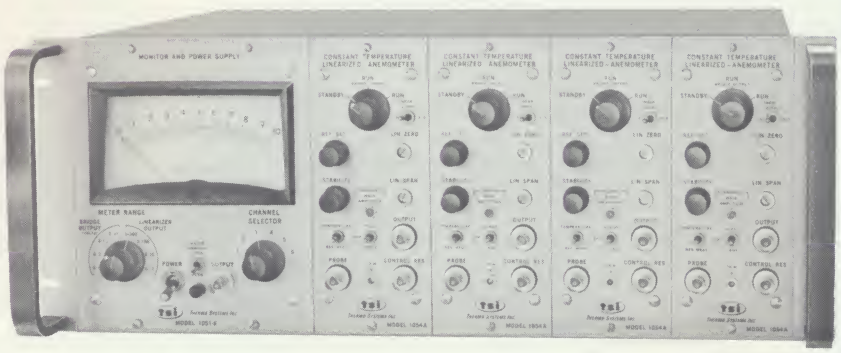
MULTI-CHANNEL SYSTEMS

For simultaneous measurements at several locations or complex flow studies such as in three dimensional flow, pulsital profiles, analysis of fluidic devices, and airborne measurements.

A multi-channel system includes:

- **1 or more Monitor & Power Supply Modules**
- **3 or more Anemometer Modules**
- **1 or more Cabinets**

Probes and accessories as required (See pages 5, 6, 7).



tsi SELECTION GUIDE

Follow sequence of directions under A, B, C, D and E. All internal interconnecting wiring is done at the factory. Each system is furnished with all necessary interconnecting cables, instructions and one 15′ probe cable for each channel.

A. ANEMOMETER MODULES

The anemometer module contains the bridge and feedback amplifier plus controls for operating the sensor. Five models are available. Select as follows:

1. Determine the fluid(s) (liquid or gas), flow range(s) and general orientation needed for the probe or in-line flow sensor and select the types of sensors to be used from Bulletin N16-2, C26 or other probe catalogs.
2. From Table 4 on page 9 determine the maximum current needed for the types of sensors and flow ranges possible (numbers in parentheses). The 0.45 amp output is adequate for most sensors in air.
3. Based on power output, frequency response, noise level, linearity requirements and flexibility desired, select appropriate anemometer from table below:

TABLE I ANEMOMETER MODELS

SPECIFICATIONS	1050	1053A	1053B	1054A	1054B
Power Output (Max.)	2.5 amps	0.45 amps	0.45 amps	0.45 amps	0.45 amps
Frequency Response	350 KHz	150 KHz	5 KHz	150 KHz	5 KHz
Noise Level (Equiv. Turbulence Intensity — 0.0002″ wire)	0.02% (0-10 KHz)	0.035% (0-10 KHz)	0.03% (0-5 KHz)	0.035% (0-10 KHz)	0.03% (0-5 KHz)
Bridge(s) and Ratio	4 Bridges 5:1 and 1:1	One 5:1	One 5:1	One 5:1	One 5:1
Control Resistor	Variable Decade Built-in (0-60 ohms) Model 1305 Control Res. for 1:1 Bridge or Temp. Comp. Probe	Use Model 1056 Variable Decade, 1304 Control Res. or Temp. Comp. Probe	Use Model 1056 Variable Decade, 1304 Control Res. or Temp. Comp. Probe	Use Model 1056 Variable Decade, 1304 Control Res. or Temp. Comp. Probe	Use Model 1056 Variable Decade, 1304 Control Res. or Temp. Comp. Probe
Square Wave Built-in	Yes	Yes	No	Yes	No
Linearizer	Use 1055	Use 1055	Use 1055	Built-in	Built-in
No. of 1/6 Panel Widths	2	1	1	1	1

MODEL 1050

The Model 1050 is the most advanced general purpose unit with overall performance superior to any other anemometer available. It is recommended for laboratories with a variety of flow and turbulence measurements. It is required for high speed liquids and any cooled sensor measurements.

See Specification Sheet 1050.

MODEL 1053A, B

Model 1053 modules offer a good combination of features for work in gases and low velocity liquids. The 1053A has high frequency response and controls for optimizing frequency response and measuring temperature. The Model 1053B is a lower frequency unit which meets most atmospheric and industrial measurement requirements.

See Specification Sheet 1053.

MODEL 1054A, B

The 1054 Modules are similar to the 1053 Modules, but in addition have a built-in linearizing circuit. Model 1054A is a high frequency general purpose circuit with controls for measuring and adjusting frequency response. The 1054A also has an output amplifier (XI or X10) for more meter ranges and better output sensitivity at low flows. Both models use Type 1117 interchangeable Linearizer Cards to set the linearizing curve shape for a given sensor and flow combination. The appropriate dash No. from Table IV, page 9, must be specified to have the proper 1117 card included. See Specification Sheet 1054.

B. MONITOR AND POWER SUPPLY MODULES

These modules supply power to other modules in the system and provide D.C. readings of system variables for each channel. To select proper unit:

1. Determine maximum current required for the number of channels needed based on Item 2 under A.
2. Select from Table 2 below on basis of power needed, line power source and number of anemometer channels. (Auxiliary channels operate on same channel as corresponding anemometer module.)

TABLE II MONITOR AND POWER SUPPLY MODULES

SPECIFICATIONS	1051-1	1051-2	1051-6	1051-1b*	1051-28V*
Max. Power Output	0.5 amps	1.5 amps	3.0 amps	1.2 amp-hours	Depends on 28V D.C. Source
Max. Number of Channels	1	2	6	1	10
No. of 1/6 Panel Widths	2	2	2	2	1
Line Voltage Required	110-220 VAC 50-400 Hz	110-220 VAC 50-400 Hz	110-220 VAC 50-400 Hz	Built-in Rechargeable Battery	26 ± 3V D.C.

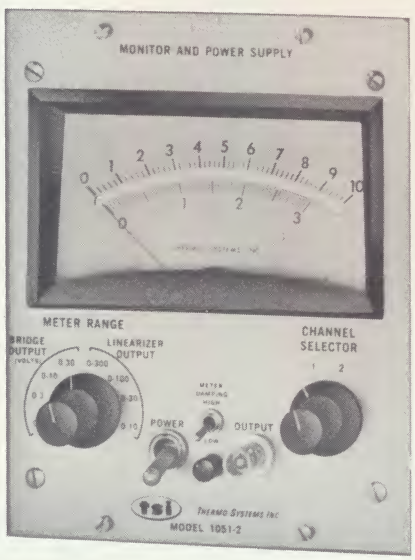
*Can be used only with 1050 and 1053A, B anemometer modules.

THE MODEL 1051 Monitor and Power Supply Modules are equipped with regulated power supplies for each modular function. A unique interconnecting system is incorporated for conveniently adding or changing modules.

PANEL METER — The meter will monitor bridge output, linear output, temperature output (for Model 1040 Temp. Module) and correlator outputs both before and after suppression. The ½% taut band meter has 4 bridge voltage ranges (also used for temperature) and 4 linearized output ranges calibrated in the flow units determined by the linearizer function.

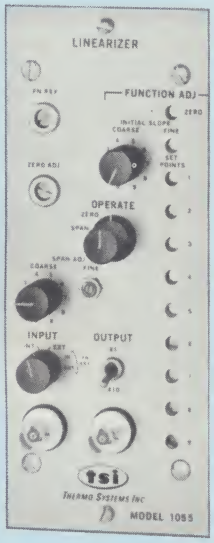
CHANNEL SELECTOR — The output of each channel is fed to the 1051 module for selective readings on the panel meter and output jack. (All channels have simultaneous outputs independent of the signal fed back to the Model 1051.) The channel selector will also switch the Model 1060 RMS meter between channels.

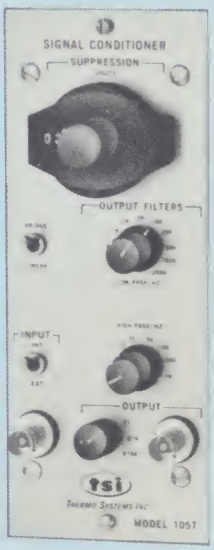
See Specification Sheet 1051.



C. AUXILIARY MODULES

The Anemometer Module and Monitor and Power Supply form a complete system. The auxiliary and accessory modules add utility and flexibility.





D. ACCESSORY MODULES

MODEL 1055 LINEARIZER MODULE

The Model 1055 Linearizer is a general purpose, variable function circuit using a series of 10 adjustable amplifiers to develop a linear output from the output of a constant temperature anemometer or other device.

FEATURES

Adjustable Function — The linearizing curve shape can be varied over a wide range of equivalent exponents (0.5 to 5.0) with the added feature of matching non-exponential curves such as most anemometer calibrations. No external instruments are needed to set up the function for a new curve. (The 1057 Signal Conditioner or an accurate external voltmeter is recommended for improving accuracy.) The general purpose function card included with each 1055 Linearizer is adjustable on the front panel. The user can also purchase Model 1117 function cards (Table IV, page 9) which are accurately adjusted at the factory. When ordering a Model 1055 specify one of the dash no.'s from Table IV to have the linearizer preadjusted for your initial application. Instructions are included for adjusting to the Table IV curves as well as the user's own calibrations.

Frequency Response: D.C. to 200 KHz.

Noise Level: 50 μ Volt RMS (Equivalent input).

Output: Range 0 - 10 volts for all input ranges (calibrated in flow units). Output Amplifier X1 and X10.

Use With: Model 1050, 1053A, 1053B, other inputs.

See Specification Sheet 1055.

MODEL 1056 VARIABLE DECADE MODULE

The Model 1056 Variable Decade consists of four resistance decades covering a resistance range of 0 to 60 ohms in 0.01 ohm steps when used with a 5:1 bridge. This unit is designed for use with 1053A, 1053B, 1054A and 1054B Anemometer Modules. It enables the operator to measure the probe resistance and set the operating resistance over a range of conditions, making the Anemometer a more general purpose instrument. High quality precision (0.1%) resistors with low temperature coefficient are used throughout. A potentiometer is included to null out the cable, probe and probe support resistance so the digital dials read sensor resistance directly.

See Specification Sheet 1056.

MODEL 1057 SIGNAL CONDITIONER

The Model 1057 Signal Conditioner has three functions as follows:

ZERO SUPPRESSION: A precise (0.1%) D.C. voltage can be subtracted from the Anemometer or Linearizer output signal in 1 volt increments (up to 30 volts). This allows readings on the most sensitive meter scales, improving D.C. reading accuracy to the 0.1 to 0.2% level on a ½% F.S. meter. The output and meter signals are both suppressed (low impedance output) for usage with external meters, oscilloscopes, etc. This is particularly useful for the non-linear output where small differences occur at high flows.

INPUT AND OUTPUT FILTERS: Both high and low pass filters with sharp cutoff (12db/octave or 50 db/decade on low pass) are built in for removing frequencies outside the band of interest. LOW PASS RANGES from 200 Hz to 200 KHz and HIGH PASS RANGES from 5 Hz to 1KHz.

OUTPUT AMPLIFIER: The A.C. portion of the signal can be amplified X10 or X100 at the output jack. An internal switch selects the low frequency cutoff at either 1 Hz or 0.1 Hz. The amplified output is convenient for feeding recorders or low sensitivity instruments for data analysis.

The 1057 Signal Conditioner can be used with other instrumentation systems as a zero suppression device, filter and amplifier.

See Specification Sheet 1057.

1015C CORRELATOR

The 1015C Correlator contains two summing circuits, a differencing circuit and a differentiating circuit. This system has frequency response from D.C. to 200 KHz and noise level of less than 50 μ volts at unity gain.

FUNCTIONS

1. With one summing circuit (and a true RMS voltmeter on the output) a cross-product correlation between two random input signals is measured.

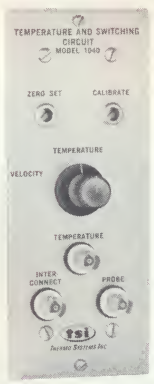
2. On D.C., with linearized anemometer outputs, the sum and difference signals from an "X" array probe are proportional to the velocity components in two-dimensional flow.

3. Using the differencing circuit and two summing circuits with an "X" array probe, the correlation coefficient between two turbulence components can be read directly on the true RMS meter. The sum and difference signals can also indicate turbulence intensities, Reynold's stresses, and integral scale.

4. The differentiating circuit measures turbulence microscale.

The Model 1015C Correlator is furnished with its own power supply and cabinet, but can also be mounted in a ⅓ panel width of a modular cabinet.

See Specification Sheet 1015C.



MODEL 1040, 1040A, TEMPERATURE AND SWITCHING MODULE

The Model 1040 contains a resistance bridge and output amplifier which will operate a hot wire, hot film or other resistance element as a resistance thermometer to indicate temperature directly. The sensor can be operated in either the 1040 temperature bridge or the anemometer velocity bridge by switching on the 1040 panel. This allows a direct measurement of both velocity and temperature at the same location. The Model 1040A has a solid state switch that repeatedly switches between velocity and temperature at adjustable rates. Temperature output is 0 - 10 volts for the temperature range required.

See Specification Sheet 1040.

MODEL 1060 TRUE RMS VOLTMETER

The new 1060 RMS meter represents the first such circuit designed principally for mechanical measurements. This is an all solid state circuit with frequency response, sensitivity, crest factor, time constants and outputs ideally suited for anemometry as well as other mechanical measurements such as vibration, pressure, acoustics, etc. With long averaging times, accurate response to extremely low frequencies, low output impedance, and large outputs this unit is useful for even low frequency liquid turbulence measurements. The panel meter reads the RMS voltage, mean square or correlation coefficient (when used with the correlator). Both RMS and mean square outputs (0-10V) are available.

The Model 1060 is furnished with its own power supply and cabinet but can be mounted in a ⅓ panel width of any cabinet. If desired, the channel selector switch on the 1051 Monitor and Power Supply Module will switch the RMS meter between channels.

See Specification Sheet 1060.

MODEL 1025 TEMPERATURE COMPENSATOR

The Model 1025 utilizes a resistance bridge that senses flow temperature from a small sensor located near the velocity sensor and corrects the anemometer bridge for temperature. The temperature sensor can be a second hot wire or hot film sensor such as on a standard 2-sensor probe. The advantages of this system are: the variable bridge decades for the anemometer can still be used to set overheat; adjustments for different temperature coefficients between the temperature and flow sensor can be made; and very little heat is dissipated in the temperature sensor allowing it to be as small as the velocity sensor.

The 1025 has its own power supply and cabinet but can be mounted in any modular cabinet as well.

E. CABINET SELECTION

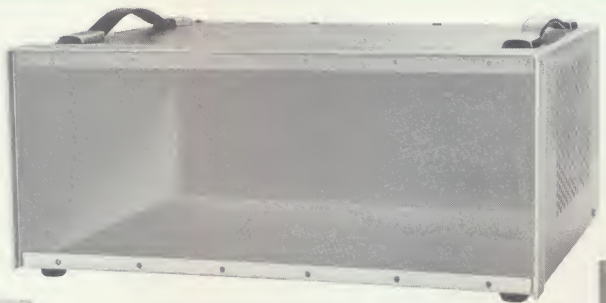
A variety of cabinets is offered for portable units, bench instruments and rack mounting. To obtain the proper cabinet or combination of cabinets proceed as follows:

1. Determine the total number of 1/6 panel widths required for the modules chosen.
2. If there are 3, 4, 6 or 12 widths select the appropriate single cabinet.
3. If the number of 1/6 panel widths does not correspond to a standard cabinet either order blank panels or order a combination of separate cabinets. (Note that the RMS meter, correlator and temperature compensator can be used as complete separate instruments if desired.)

TABLE III CABINETS

MODEL NO.	No. of 1/6 Panel Widths	Fan Included	Furnished with Rack Mounting Hardware
1058-3	3	No	No
1058-4	4	No	No
1058-6*	6	No	Yes
1058-6F*	6	Yes	Yes
1058-12*	12	No	Yes
1058-12F*	12	Yes	Yes
10115	1 (blank panel)	—	—

*A fan is required (1058-6F or 1058-12F cabinet) when the 1051-6 Monitor and Power Supply is supplying more than two amps.



See Specification Sheet 1058-6.

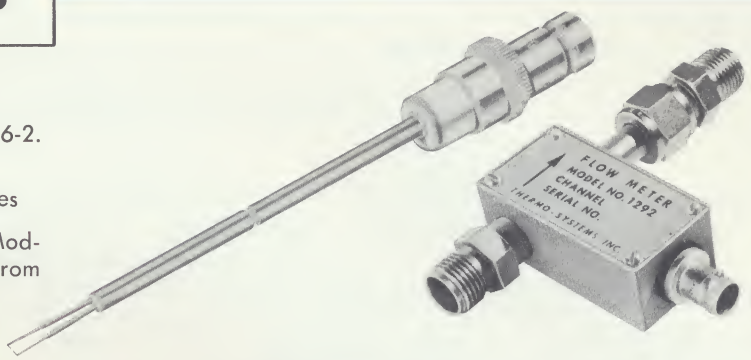
See Specification Sheet 1058-3.

See Specification Sheet 1058-12.

PROBES AND SENSORS

Two basic types of transducers are offered:

1. Probes for point measurements shown in Bulletin N16-2. These include:
   • Hot Wire Probes • Quartz Coated* Hot Film Probes
2. In-Line Flow Sensors for measuring total mass flow (Model 1292 and 1352.) Ranges for liquids and gases from 0.1 cc/min to 30,000 lbs/hr.



TEMPERATURE COMPENSATION

Both velocity probes and mass flow sensors are furnished either with or without temperature compensating windings. For laboratory work it is common not to temperature compensate and operate the sensor at a fixed elevated temperature. Temperature changes less than 5°F in gases or 1°F in liquids often can be neglected or temperature can be measured separately and the data corrected. When compensated, the compensating winding is either mounted on a separate probe located in the flow stream or built into the same probe as the flow sensor.

HOW TO ORDER PROBES FOR THE 1050 SERIES:

If Not Temperature Compensated:

1. Determine type and size of probe and sensor (see Bulletin N16-2).
2. Determine appropriate Control Resistor from following choices:
   a. VARIABLE BRIDGE DECADE — Built into Model 1050 and as a separate Model 1056 Module — recommended for general purpose systems and where sensor temperature must be varied.
   b. MODEL 1304 CONTROL RESISTOR — A fixed external resistor purchased for each probe used on a 5:1 bridge when *not* equipped with Variable Decades — inexpensive and convenient for fixed applications.
   c. MODEL 1305 CONTROL RESISTOR — A fixed external resistor purchased for each probe used on the 1:1 High Frequency bridge in the 1050 Anemometer for maximum frequency response.

If Temperature Compensated:

1. Select probe or mass flow sensor from Bulletin N16-2 or 1350.
2. If temperature compensating winding is not built into the device, select a separate (1310 or 1312) Compensating Probe. The temperature compensating winding becomes the control resistor.

*Patented.

COOLED PROBES — For work in hot gases, TSI offers a line of cooled probes and sensors. See Bulletin C26.

MODEL 1117 LINEARIZER FUNCTION CARDS — PROBE CURRENT REQUIREMENTS

The Plug-In Linearizer Function Cards are interchangeable with the function cards mounted in Model 1054A, 1054B and 1055 Modules. Each type of fluid, flow range and sensor requires a different Model 1117 Function Card for best linearity. (The 1055 module is originally equipped with an adjustable card — the 1117 card can be substituted if a fixed function or higher accuracy is desired.)

1. The dash numbers in the table should be specified when ordering 1054 or 1055 modules and extra 1117 cards. Other calibrations can be furnished upon request.
2. The figure in parenthesis is the maximum current (amps) required for that sensor and flow range. It is not part of the order number.

TABLE IV

SENSOR TYPE OR MODEL		Total Range					
		Air			Water		
		0–30fps	0–30mps *	0–300fps	0–3fps	0–3mps*	0–30fps
Cylindrical Hot Film	(—10A) 0.001" dia x 0.010" long	—1 (.05)	—44(.07)	—2 (.09)	—10(.2)		
	(—10) 0.001" dia x 0.020" long	—11(.09)	—45(.1)	—12(.12)	—14(.24)		
	(—20) 0.002" dia x 0.040" long	—3 (.12)	—46(.14)	—4 (.18)	—6 (.42)	—48(.6)	
	(—60) 0.006" dia x 0.080" long	—16(.24)	—47(.29)	—17(.35)	—19(1.1)	—49(1.4)	
Single Ended Hot Film	(—25A) 0.0025" dia x 0.010" long	—20(.05)	—50(.07)	—21(.09)			
	(—25) 0.0025" dia x 0.040" long	—51(.12)	—52(.15)	—53(.17)			
	(—60S) 0.006" dia x 0.080" long	—54(.24)	—55(.27)	—56(.30)	—57(1.0)	—58(1.3)	
Conical Hot Film 1230, 1231				—23(.27)	—7 (.20)	—38(.25)	—8 (.32)
Wedge Hot Film 1232, 1233				—40(.29)	—41(.30)	—42(.36)	—43(.55)
Side Flow Wedge Hot Film 1234				—25(.29)	—27(.30)	—39(.36)	—28(.55)
Parabolic Hot Film 1235, 1236				—32(.30)	—33(.30)	—36(.38)	—35(.55)
Hot Wire	(—T1.5) 0.00015" dia. x 0.050" long	—29(.06)	—37(.07)	—30(.09)			
In-Line Mass Flow Sensor		Specify Model No., fluid, temp. and flow range					
Pressure Transducer		Specify Model No. and pressure range					

*Meters per second

CALIBRATION

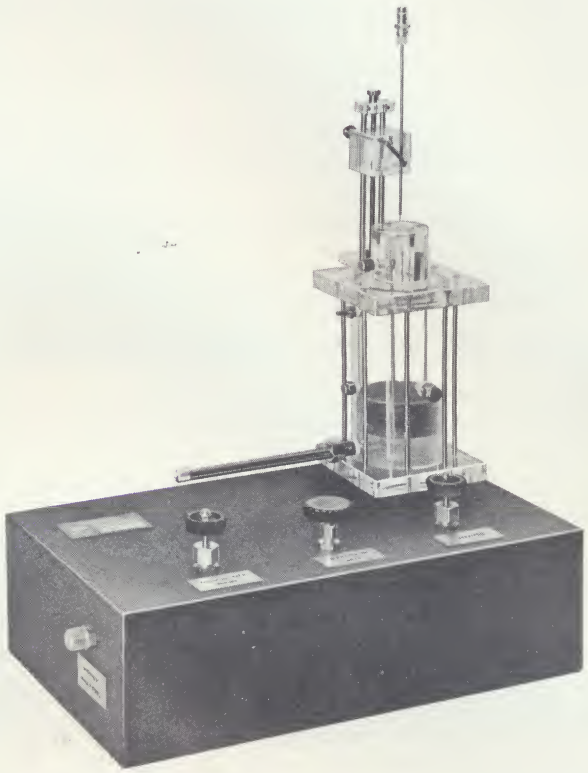
TSI can provide calibrations for any of the probes and flow sensors shown in a variety of gases and liquids. The Model 1125 Calibrator can be used by the customer to calibrate probes and check calibrations in his own laboratory.

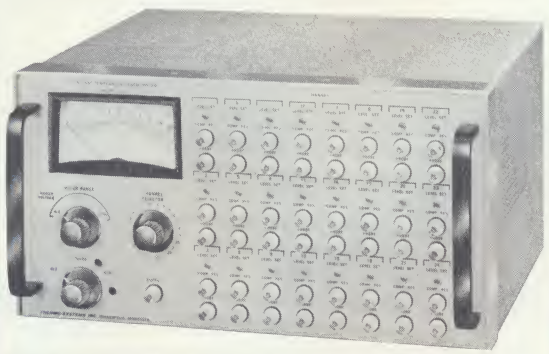
MODEL 1125 PROBE CALIBRATOR

The Model 1125 Probe Calibrator can be used for calibrating TSI probes in most gases and many liquids with some modifications. The customer furnishes his own source of fluid (e.g., compressed air) and measures pressure difference across a nozzle using a manometer or other pressure measuring device. There are three calibrated passages in the calibrator in which velocity is known as a function of the measured pressure difference. Velocity ranges in air are 0.05 fps to 3 fps, 3 fps to 60 fps and 60 fps to sonic with overlap between ranges.

A series of fine screens flattens the profile and controls the turbulence level. Adapters are included for mounting all TSI probes. Each 1125 is furnished with pressure regulator, filter and trap, needle valve, well thermometer, calibration curves and instruction manual. Manometers can also be furnished.

See Specification Sheet 1125.





INTEGRAL MULTI-CHANNEL SYSTEM

The Model 1045 is a versatile anemometer system for operation of up to 24 channels. Each channel has the same operating specifications as the Model 1053B non-linearized Anemometer Module. Each channel has a fail safe circuit to avoid any sensor burn-out due to interruption of power, probe leads, etc. This system illustrates the versatility of the many anemometer systems that can be furnished by TSI.

Thermo-Systems' continuing R & D efforts are directed toward improvement and further development of anemometers and related flow measuring products. This effort has resulted in several "firsts" including high frequency solid state constant temperature anemometers, quartz coated hot film sensors, cooled sensors and modular anemometers. Thermo-Systems maintains a concerted program of product development.

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